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ABSTRACT

A study examined whether the technique of having students ask "active questions" (in the form of "I understand that...but I don't understand...") enhanced critical thinking and overall performance in the classroom. Subjects, 164 students in six tenth-grade biology sections and four junior-senior astronomy/geology sections, responded to a questionnaire concerning their opinion on the usefulness of active questions. Results indicated that: (1) active questions were helpful to students' learning and to their grade; (2) the questions introduced new ideas to students; (3) active questions made for more interesting classroom discussions; (4) students did not support using active questions in other classes; and (5) many students indicated that active questions negatively affected their feelings about the class. Active questions have made a difference in the classroom: students are generally more attentive, and through their questions, they have made the classroom a more relevant place. (One table of data is included.) (RS)

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Steven Williams

ACTIVE QUESTIONS Steven F. Williams

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC):

Active Questioning is a way to get students more involved in their learning. The technique was introduced at a Douglas County School District science seminar in the spring of 1990. This teacher-friendly strategy can help students become more thoughtful and it can improve classroom atmosphere. It does this by gently pressuring students in order that they might become more personally involved in their education.

"I like the active questions because they helped my grade. They helped me to think more about what was being discussed in class and think of whether I understood what we were talking about or not. By making the active questions 10% of our grade, it motivated us to ask a question if we were lost, whereas, at other times, a lot of us would just sit back and listen to what was going on instead of putting forth the effort to understand."

"I think they were a good idea. It was hard for people to get into it. But of course everything different at our age is "stupid" at first until someone shows enough courage to start asking the first question each day."

Active questions are asked using the following format: "I understand that ... but I don't understand ... : " For example, "I understand that temperature increases with depth in the earth but I really do not understand exactly what the role of

At the beginning of the year I wasn't very excited about active questions. When other people asked the questions the way it was worded sounded stupid. So I didn't ask any during 1st quarter & it really hurt my grade. When I started asking them this quarter it made me think more about what we learned. I think that I did learn something from asking the active questions and they helped me, not only gradewise, but also knowledgewise."

radioactivity is in this." Another example is, "I understand that Darwin and Lamarck both believed in evolution, and both believed that the environment played an important role in changing animals, but I don't understand why Darwin is right and Lamarck is wrong." These questions often open the door into quite lengthy discussions that can be somewhat off the subject but are very relevant to the students and often lead to higher-order thinking, a worthwhile journey. Active questions also give the teacher a window into their students' minds, whereby understanding and comprehension can be better monitored. Active questions are intellectually stimulating and many students appreciate them because they are new and fresh and change routine.

I require that each student ask five active questions per quarter. The five questions are graded in an all-or-nothing manner at the time that the student asks them; full credit is earned for the question or none at all. A bookkeeping problem was solved by simply marking the seating chart with the date during class and then transferring the mark into the gradebook later. The five questions are worth 10% of the total grade each quarter. Only one active question can be asked per day for credit although any number and type of questions can be asked during the class period. This format is the "tried and true" one suggested at the science seminar.

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I believe in active questions for a variety of reasons, most of which are of the "feel good" variety. The format is used primarily to move the student from the passive-recipient role into one of active-participant. This places students in an unaccustomed role, however, and sometimes they bridle at the prospect of questioning because they are forced into producing knowledge rather than just having it handed to them. Examples of this are statements like, "I don't need to ask questions because I already understand everything"; or, "If he (the teacher) does the talking, I don't have to think." I feel good about getting students to think. I feel good about getting them to go beyond the role of "understanding everything" and into the role of "problem finder."

Active questions are an excellent vehicle for involving students in their own learning as well as moving them up the cognitive ladder. I have noted that they become more thoughtful as they consider how to phrase their questions. Active questioning legitimizes "dumb questions" and validates questioning in general. This is just the ticket for those students who don't dare be "nerds", but now, with great relief, are "forced" to ask their questions. Some students are concerned with the process because it puts them "on stage," and this is too much of a risk. However good one-on-one discussion and a meaningful introduction of the process at the beginning of each semester can minimize these concerns.

Initially I wondered if this technique would enhance critical thinking and overall performance in the classroom? Would students be positively affected by it? Would my students become more thoughtful and active learners?

SURVEY

In order to answer these questions I gave my students a nine-question survey. Students were surveyed at the end of both semesters of the 1990-1991 school year. Students also responded to each of the Likert scale questions with one or two sentences of explanation. They supported their choices remarkably well and I am quite comfortable with the sincerity of their responses. There were three essay questions and six Likert style questions, the six of which you will find with tallied results below. A total of six tenth-grade biology sections and four junior-senior astronomy/geology sections were sampled. There were 164 responses to the questionnaire.

The following is the key and the Likert scale's six questions. The sum totals of student responses, separated by grade, are italicized and are found below each category, as indicated to the left of each question.

SURVEY RESULTS : TALLIED BY GRADE

KEY:	1	2	3	4	5
	(NEVER)		(SOMETIMES)		(ALWAYS)
	(NO)				(YES)
	(DISAGREE)				(AGREE)

*sum of
student
responses*

	1. Active Questions Introduced new Ideas to me.				
	1	2	3	4	5
<i>grades 10:</i>	4	16	42	29	9
<i>11-12:</i>	1	4	22	31	6
	2. Active Questions made for more interesting discussions.				
	1	2	3	4	5
<i>grades 10:</i>	5	11	24	26	35
<i>11-12:</i>	1	2	15	25	21
	3. Active Questions were helpful to my learning.				
	1	2	3	4	5
<i>grades 10:</i>	6	22	31	20	21
<i>11-12:</i>	3	10	20	19	20
	4. Active Questions helped me feel better about the class.				
	1	2	3	4	5
<i>grades 10:</i>	22	29	20	19	21
<i>11-12:</i>	13	12	22	12	6
	5. Active Questions helped my grade.				
	1	2	3	4	5
<i>grades 10:</i>	23	9	11	19	36
<i>11-12:</i>	5	9	9	4	35
	6. I wish other teachers would use active questions.				
	1	2	3	4	5
<i>grades 10:</i>	37	9	17	19	18
<i>11-12:</i>	16	9	12	8	18

FINDINGS

Students reported that active questions were helpful to their learning and to their grade, that the questions introduced new ideas to them, and that they made for more interesting classroom discussions (questions 1,2,3,and 5). Students generally did not support using active questions in other classes, however, and many indicated that active questions negatively affected their feelings about the class (questions 4 and 6). It was interesting to read their explanations for these responses, however, because they often did not support the more negative 1's and 2's circled as well as they did the more positive 4's and 5's. I have the impression that students appreciated the positives gained through the technique but some would rather not put forth the effort in order to make them happen.

I was not able to determine whether overall performance was enhanced by the use of active questions because there were too many uncontrolled variables. For instance, not enough classes were taught for reliable comparisons to be made. A new schedule of 85-minute classes, meeting every other day, limited my comparisons with the fifty-three minute classes taught daily in the past, and I did not run a control group. I am confident that critical thinking was enhanced and that active questions engendered more thoughtful and active learning.

I have found that even the questions asked mindlessly, just for credit, lead into interesting discussions; although acceptance of these types of questions were a major criticism by my students.

Active questions have changed my perception of time and coverage of material. Time is sometimes lost and I have to be flexible because students occasionally become so involved in a topic that quizzes are cancelled or topics are not covered according to my schedule. I am happy to modify my schedule and give up some control as students begin to "drive" the class.

There are times, too, that I cannot answer their questions quickly enough, or at all, and there is a lesson in that, too. At such times I attempt to model thoughtful problem solving behavior for them. For instance; "Let's see now . . . we know this about that . . . and if this works this way then . . . and we understand this other angle . . . et cetera." This makes science more real to them and demonstrates that teachers do not always have every answer at hand and that the gain of scientific knowledge is driven by questions, ponderings, not knowings, mistakes, and the consequent search to find answers. It teaches that scientific knowledge is a way of thinking and a way of investigating as well as a body of knowledge.

THOUGHTS

Some students are genuinely shy, and creative ways to overcome this condition need to be found. While holding them accountable I also need to be considerate of their feelings. One thing that may help is allowing them a choice between two types of question formats. Another format may require the "What if. . . or the If . . . then . . ." format. Another modification might be to work out something where written active questions would be acceptable once they were read outloud.

I have seen a difference in my classroom this year. Students are generally more attentive and through their questions they have made the classroom a more relevant place. Sometimes their questioning takes us into uncharted places and this provides for some unexpected adventures. This is exciting to them as well as to me.

I will use active questions in my classroom next year, and the "virus" is spreading. The three teachers of our chemistry department have committed to active questions for next year, too.